

# ARISTOTLE'S AND HANS DRIESCH'S SUBSTANTIAL FORM (μορφή) AND ENTELECHY (έντελέχεια) AS BASIC CATEGORIES INTEGRATING ORGANIC DEVELOPMENT

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**ABSTRACT.** *The main subject of methodological analyses presented in this article will be the compilation and comparison of two concepts referring to the phenomenon of integration in the area of morphogenesis. Both conceptual categories (the substantial form and entelecheia) were introduced to philosophy by Aristotle in antiquity. Entelecheia itself, as a systemic category, at the turn of the 19th and 20th centuries, obtained an “other” meaning, which were given to it by Hans Driesch. Driesch has made it a dynamic factor integrating developmental processes, which can be treated in the same way as the substantial form (morphe) advocated by Aristotle. In such a comparison of both these two categories, one should remember to maintain a certain “methodological distance” when describing and comparing the structural components of the Aristotle and Hans Driesch systems. Author expects that his research approach could contribute to shedding light on studying the intertwining themes of Aristotle’s Biocosmology and Hans Driesch’s philosophy of organic world.*

**KEYWORDS:** Aristotle, Hans Driesch, entelecheia, substantial form, matter, potential, energy, morphogenesis

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## СУЩЕСТВЕННАЯ ФОРМА (*μορφή*) И ЭНТЕЛЕХИЯ (*ἐντελέχεια*) АРИСТОТЕЛЯ И ГАНСА ДРИША – КАК ОСНОВНЫЕ КАТЕГОРИИ, ИНТЕГРИРУЮЩИЕ ОРГАНИЧЕСКОЕ РАЗВИТИЕ

Дариуш ШКУТНИК

**АБСТРАКТ.** Основным предметом методологического анализа, представленным в данной статье, является сравнение и сведение воедино двух понятий, относящихся к явлению интеграции в области морфогенеза. Обе концепции (существенная форма и энтелехия) были введены философией Аристотелем в античное время. Но на рубеже XIX и XX веков энтелехия, как оригинальный концепт и системная категория – получила «другое» значение, которое было дано ей Гансом Дришем. Дриш сделал энтелехию движущим (вызывающим изменения) фактором, интегрирующим процессы развития, который может расцениваться так же, как и существенная форма (морфе), которая отстаивалась Аристотелем. При таком сравнении двух этих категорий следует помнить о сохранении определенной «методологической дистанции» при описании и сравнении структурных компонентов систем Аристотеля и Ганса Дриша. Автор полагает, что его исследовательский подход может помочь пролить свет на изучение переплетающихся тем биокосмологии Аристотеля и философию органического мира Ганса Дриша.

**КЛЮЧЕВЫЕ СЛОВА:** Аристотель, Ганс Дриш, энтелехия, существенная форма, материя, потенциал, энергия, морфогенез.

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#### Заключение

## Introduction

The subject of methodological analyses presented in this study will be the discussion and comparison of two categories explaining the phenomenon of integration in the area of morphogenesis: Aristotelian substantial form<sup>2</sup> and entelecheia<sup>3</sup>. Entelecheia is a concept coined by Aristotle which at the turn of the 19th and 20th centuries was taken over (for his own use) by Hans Driesch<sup>4</sup>. Both system standpoints (i. e. Aristotle and Driesch) are extremely similar in methodological terms, while maintaining the fundamental distinctions between the formulations of basic concepts used by both scientists in their advanced cognitive biocosmologies.

The epistemological approach to both research approaches will therefore not only be of a comparative nature of two dynamics integrating as systemic elements of both scientists, but also of a methodological nature, shedding light on the meaning and function of particular conceptual categories within the discussed systems. The research approach in this article is limited mainly to one basic category presented by both scientists. The remaining concepts have been discussed in so far as their meaning is closely related to a proper understanding of the general functioning of the rationality systems of Aristotle and Hans Driesch.

A comprehensive study, including detailed analysis of the conceptual relations of particular conceptual categories, would require a separate in-depth study. This text can be treated as its own interpretation of this important issue in the scope of selected conceptual categories of Aristotle and Hans Driesch. In addition, it should be noted that the discussed issues are important because they are often overlooked by both scientists as well as philosophers of biology.

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<sup>2</sup>The main way of existence of living substances – in Aristotle's view – is their understanding because of their form as souls. The definition of the soul as a form of a natural body, having life in potency, shows the character of the relation of form to matter in living beings [De anima, II, 412 and 20-22].

Aristotle also gives a definition of the soul in which it defines the substance form as the first act [De anima, II, 412 and 27-28].

<sup>3</sup> Both these two conceptual categories have a different cognitive meaning in both systems. It should be noted here that it was Aristotle who was the first to coin the term entelechy, Driesch at the turn of the 19th and 20th centuries modified, in his own way, the proper meaning of this term

<sup>4</sup> I will discuss both positions from the normative perspective, which is characterized by the requirements of the methodology of science, so I will not take into account all the work of Aristotle and Hans Driesch, as well as not all of their views so far; and I will take into account, to varying degrees, their views; both individual works of Aristotle and Driesch, as well as discussion of their positions. I am guided by the criteria of a research approach, which is appropriate for the methodology of science. It requires, in contrast to the history of science or philosophy, paying attention only to those elements of the researched position, in which specific structures and methodological operations, characteristic for the research approach, are visible as clearly and unambiguously as possible. Cf. K. Ajdukiewicz: *Język i poznanie*, tom I–II, Warszawa 1985, *Logika pragmatyczna* Warszawa 1965; A. Grobler, *Metodologia nauk*, Kraków 2006; E. Nagel., *Struktura nauki*, Warszawa 1961.

## 1. Aristotle and Hans Driesch. Two ways of “organizing” the matter

In Aristotle's view, the nature of the form was an action<sup>5</sup>, so the form was a kind of energy. The form was a component of being, therefore also energy, activity was the essence of being. The fact that a form was identified as an element of a given being does not mean that it occupied some space, but simply “works”. Aristotle clearly formulated the energy conception of existence (in his *Metaphysica*, VIII). If the form is energy, then matter is potency (force and possibility). Unlike acting force, it is an instruction. The pairs of terms, potential-energy and form-matter explained the process of becoming, i.e. update of potency.

Reality is a potential that has already been updated. From this research point of view, for example, the growth of a plant is updating (“energy”) of potency contained in the seed, while a mature plant is update of the potency with the use of the so-called “energy” *entelecheia* [Tatarkiewicz 2009, p. 126]. Essentially, as M. Leunissen discloses: “The term *entelecheia* was coined by Aristotle, and designates a completed state resulting from an internal movement towards this state; see Ritter (1932; 1934) and Johnson (2005, 88–90).” [Leunissen, 2010, p. 53]

Therefore, we must strongly emphasize that the Aristotelian category of *entelecheia* cannot be a peculiar “timeliness”, which directly results from the basic concept of Aristotle, that the soul is a synonym to the natural body's *entelecheia*. For instance, citing the Aristotelian *De Anima*:

Now the soul is cause and origin of the living body. But cause and origin are terms used in various senses: accordingly soul is cause in the three senses of the word already determined. For the soul is the cause of animate bodies as being in itself the origin of motion, as final cause and as substance. Clearly it is so as substance, substance being the cause of all existence. And for living things existence means life, and it is the soul which is the cause and origin of life. Furthermore, actuality is the notion or form of that which has potential existence. Manifestly, too, the soul is final cause. For nature, like intelligence, acts for a purpose, and this purpose is for it an end. Such an end the soul is in animals, and this in the order of nature, for all the natural bodies are instruments of soul : and this is as true of the bodies of plants as of those of animals, shewing that all are means to the soul as end; where end has two senses, the purpose for which and the person for whom. Moreover, the soul is also the origin of motion from place to place, but not all living things have this power of locomotion. Qualitative change, also, and growth are due to soul. For sensation is supposed to be a sort of qualitative change, and nothing devoid of soul has sensation. The same holds of growth and decay. For nothing undergoes natural decay or growth except it be nourished, and nothing is nourished

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<sup>5</sup> The author will call the integration factor Aristotle substantial form of the natural body, which potentially has life [DA II. 1,412a19-21]. Aristotle also describes the soul as “first actuality” [DA II. 1,412a27-28]. The texts by Aristotle also show that he treats the body of living organisms as a tool of the soul [DA II. 1,412b1-4]. In any case, in all cases it is a “holistic” role for organic processes in living organisms.

unless it shares in life. [Aristotle, *De Anima*, II, 415b3-416a6]<sup>6</sup>

In general, according to the recent study of Konstantin Khroutski [2016<sup>7</sup>], entitled as “Reinstating Aristotle’s Comprehensive Organokosmology and the genuine language of his organicist naturalism archetype”, and its section 3: “The cornerstone significance of Aristotle’s notion *entelecheia*, which cannot be translated as «actuality»” – therein the author substantiates that, due to Aristotle’s conception (that “the soul is the first entelecheia of the body”) – the thing’s *entelecheia* falls as much onto actuality, as to the potentiality (for, the soul cannot exist only in actuality, and (at the same time) be absent in potentiality); and, as well – “stating that «substance is actuality» is a clear contradiction in reasoning” [p. 409].

Therefore, likewise following Ritter’s statement, it should be stated that the concept of *entelecheia* itself, which refers directly to phenomenological structures for the explanation of organic reality by Aristotle, should mean the final state of a specific ontogenetic process [Ritter, 1932]<sup>8</sup>. Only in this cognitive approach we can talk about entelechial phenomena (*entelecheia*) in Aristotle's bio-philosophy.

The category of *entelecheia* within the meaning of Hans Driesch, which was adopted after Aristotle, is different. Driesch himself referred to Aristotle – emphasizing his merits for systematic philosophy and for theoretical biology. Moreover, Driesch believes that Aristotle was the first vitalist in the history of philosophy and science. According to Driesch, his theoretical biology was completely vitalist. Aristotle’s vitality was developed consciously, because it came into being in opposition to the mechanical dogma of the Democritus school [Driesch 1921].

In any case Driesch called *entelecheia*, after Aristotle, the factor that he had noticed as an integrator in the embryogenesis:

Let us then borrow our terminology from Aristotle, and let that factor in life phenomena which we have shown to be a factor of true autonomy be called Entelechy, though without identifying our doctrine with what Aristotle meant by the word *ἐντελέχεια*. We shall use this word only as a sign of our admiration for his great genius; his word is to be a mould which we have filled and shall fill with new contents. [Driesch, 1908, p. 144]

He borrowed this term from Aristotle, but without however equating the fundamentals of his theory with the fundamentals of Aristotle's theory. Driesch made

<sup>6</sup> Cited from: Aristotle. (1907). *De Anima*. Ed. by Robert Drew Hicks. Cambridge: Cambridge University Press.

<sup>7</sup> See: Khroutski, Konstantin S. (2016). “Reinstating Aristotle’s Comprehensive Organokosmology and the genuine language of his organicist naturalism archetype,” *Biocosmology-Neo-Aristotelism*. Vol. 6, Nos. 3&4 (Summer/Autumn 2016), pp. 394–413.

<sup>8</sup> Antonio C. Garcia-Bellido and Antonio Garcia-Bellido present, in the concept of Aristotle, an entelechy model referring to cellular proliferation and communication, leading to the final shape of a morphogenetic space of final shape and size. A. C. Garcia-Bellido, A. Garcia-Bellido, Cell proliferation in the attainment of constant sizes and shapes: the Entelechy model, *The International Journal of Developmental Biology* 1998 (42), pp. 353–362.

it clear that from Aristotle he took only the name for his distinguishing entelecheia factor. He wanted to use the words *entelecheia* only as an expression of a certain reverence for the great genius of Aristotle. However, Driesch endowed this word of a new content, based on experimental research and in-depth theoretical analysis [Driesch 1921].

As we will see in further reflections, Hans Driesch's research stands extremely similar to Aristotle's biocosmological stance. Already, however, some fundamental similarities and differences in the attribution of certain conceptual properties to particular research categories used by both philosophers can be pointed out. It is believed that the concept of Aristotle's substantial form (as it can be found in his *Metaphysica*, VIII) should be understood as energy that "works", with matter being potency. According to Driesch, entelecheia as a factor that integrates processes in morphogenesis is not energetic<sup>9</sup>:

But entelechy lacks all the characteristics of quantity: entelechy is order of relation and absolutely nothing else; all the quantities concerned in its manifestation in every case being due to means which are used by entelechy, or to conditions which cannot be avoided. [Driesch, 1908, p. 169]

In his view, energetic entelecheia would lead to certain discrepancies in the living system, in which specific types of energy also interacted among themselves, which Driesch explained on the basis of the laws and principles adopted by classical physics. In Driesch's interpretation, the factor integrating entelecheia was therefore non-energy.

Mariska Leunissen, while describing one of the definitions of Aristotle's soul as a substance form, pointed out that this category – understood as "first actuality" – may mean that the soul is a certain *hexis*, or "disposition" for actions (life functions) and should not be understood as some kind of energy (*energeia*) [Leunissen, 2010]. This research approach brings the importance of the integrating factor advocated by Aristotle to a specific category of the whole postulated by Driesch.

Another fundamental difference is the spatial location of both integrating factors postulated by researchers-philosophers. Aristotle postulates the existence of an internal source of determination in living organisms (see: *De Anima*, II). The substantial form of living organisms must have the autonomous power to determine the timing order, quality of accidental acts. The change of accidental acts in the course of a life cycle, the course of phenomena in regeneration processes, and the course of metabolic transformation in this respect should be associated with the internal capacity of the substantial form.

Driesch understands entelecheia as an extraterrestrial and extra-spatial factor, which is identified with the so-called "intense multitude", acting within the material

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<sup>9</sup> Driesch believed that non-energy entelecheia could work with those inorganic means, or factors that in themselves have certain energy dependencies. In this way, the philosopher-researcher "found" certain relationships between the "living" and "inanimate" world. relations between matter and form.

space. The effect of entelecheia, according to Driesch, was based on its “suspensive” properties occurring in the course of morphogenesis. In the case of Aristotle, analogously, the substantial form has fundamental “limiting” abilities made of absolutely passive and plastic material with an internal relation to the shaping of acts possessing quantifiable features. In other words, in the opinion of Stagirite (that could be traced from his *De Anima*, II, 412 b) – the differentiating element, which gives a particular organism its overall character, is the substance form, and which is also understood as the first act that determines the quality of the possible accidental acts (second act), and which is a possible effect of the substance (the so-called second matter).

In both cases of Aristotle and Hans Driesch, the value of their explanatory systems is based on the concept of matter: first matter (Aristotle) and organic physico-chemical matter (Driesch). Both scientists pursue the epigenetic perspective. While Aristotle develops his theoretical generalizations on the basis of an assumed methodology, Driesch “intuitively” combines in his approach the Aristotelian systemic approach and the conceptual aspects of Immanuel Kant’s philosophy [Dębowski 1984, p. 3–18].

## 2. Integration factor *in actu*. Inclusion of Aristotle and Hans Driesch

Aristotle's “intention” is the only and indivisible source of richness of accidental forms, and it acts as a whole in every part of the accidental act. What limits it from the outside is the first matter, without which there cannot exist, and the specific second act, which is not accidental, because by it itself the realized form of existence. The substantial form is intrinsically determined to a specific movement, so the specific second act and the conditions existing in the environment determine the appearance of the next act. Thus, the action of the substantial form – in Aristotle's view (given in *De anima*, II, 412 a) – is revealed as a repetitive tendency to create and disclose new second acts in the order of strict dependence on external conditions, but not limited to them. Aristotle states:

Now the soul is that whereby primarily we live, perceive, and have understanding: therefore it will be a species of notion or form, not matter or substratum. Of the three meanings of substance mentioned above, form, matter and the whole made up of these two, matter is potentiality and form is actuality. And, since the whole made up of the two is endowed with soul, the body is not the actuality of soul, but soul the actuality of a particular body [Aristotle, *De Anima*, II, 413b 22-414a 13, 414a 14-414b 10]

The proliferation of organisms in relation to the hylemorphism of Aristotle<sup>10</sup> can be explained by the constancy of the substantial form and its “limiting” determination

<sup>10</sup> Aristotle's theory of hylemorphism is used mainly in researching the world of nature, where the basic reference is the material being subject to changes. However, this issue also extends to the area of metaphysics. In translating the changes in being Aristotle reference is made to the theory of act and possibility.

in matter (embryogenesis, organogenesis). This means that the stability of the substantial form as a whole remains unchanged, even though empirically it has very different accidental forms (e.g. phenotype forms) which are exchanged in succession in terms of both quantity and quality. It works in a timeless “whole” on particular phenotypic forms and in all the spatial parts of this phenotype. It is whole and the whole in every part. However, a minimum organized material structure, we say a single cell, is required to enable its operation. [Lenartowicz, 1984] If, in Aristotle's terminology, the constituent form contains the entire pool of “information” in each cell then separating one cell from the other – as Hans Driesch<sup>11</sup> had done in his biological experiments, does not overpower the action of the constituent form in each of these cells (the phenotype development intended as a spatial separation of cells is, in this sense, just a propagation of this action).

Driesch uses the term *entelecheia* (equivalent to the Aristotle's substance form) to describe the initial embryological processes in the course of morphogenesis [Driesch, 1921, p. 220]. He writes:

Entelechy has ruled the individual morphogenesis of the generation which is regarded as being the starting-point for inheritance, and will rule also the morphogenesis of the generation which is to follow; entelechy determines the egg to be what it is, and the morphogenesis starting from this egg to be what it is also. [Driesch, 1908, p. 227-228]

This proves that the integrating factor in the view of both researchers was responsible not only for the thawing up of particular phenotypes and genomes, but also for the development and construction of a new form, including its reparation and repair.

In the course of his research on the nature of *entelecheia* as a factor integrating developmental processes, Driesch has determined that it cannot be understood as any form of energy and any form of intensity. *Entelecheia* was devoid of spatial properties. It was a non-material “factor” and affected teleologically living organisms, thus contributing to increased complexity of structural elements of a living system. It acts by the possibility of suspending possible potential differences on the basis of events and released this suspension as necessary (e.g. during enzymatic catalysis). Driesch argues:

But entelechy is able, so far as we know from the facts concerned in restitution and adaptation, to suspend for as long a period as it wants any one of all the reactions which are possible with such compounds as are

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<sup>11</sup> As a reminder, Hans Driesch verified the experiment, which was the first to be conducted by Wilhelm Roux (on the egg of the green frog, *Rana esculenta*), based on the assumptions of mechanistic reductionism, which was underpinned by the mechanistic assumptions of August Weismann. Driesch, in contrast to Roux, received correct experimental results, which he gave a vitalist interpretation. Cf. W. Roux, *Beiträge zu Entwicklungsmechanik des Embryo*. V. Über die künstliche Hervorbringung “halber” Embryonen durch Zerstörung einer der beiden ersten Furchungszellen, sowie über die Nachentwicklung (Postgeneration) der fehlenden Körperhälfte. *Virchow's Arch.*, 1888, p. 114; A. Weismann, *Aufsätze über Vererbung und verwandte biologische Fragen*. Jena, Gustav Fischer, 1892.

present, and which would happen without entelechy. And entelechy may regulate this suspending of reactions now in one direction and now in the other, suspending and permitting possible becoming whenever required for its purposes. Now, after all we have said, this suspending of affinity, so to say, is to be considered as a temporary compensation of factors of “intensity” which would otherwise be uncompensated, and would lead to immediate becoming. This faculty of a temporary suspension of inorganic becoming is to be regarded as the most essential ontological characteristic of entelechy. Because it possesses this faculty without being of the nature of an energy at the same time, entelechy is the non-physico-chemical agent [Driesch, 1908, p. 180]

In other words, on the basis of his “suspension theory”, Driesch claimed that in each cell of the organic system, the chemical combinations are equal. Each cell can react chemically with any other cell. Without the participation of entelecheia, however, each cell will reach its final result very quickly to the same extent. However, entelecheia “suspends” all possible reactions, if necessary. The course of further development leaves each time the conditions of normal development itself, based on physical-chemical material foundations and some complicated regulatory reactions, which take place in it [Driesch, 1921].

In such a manner, in the opinion of the philosopher, highly complicated chemical processes with the participation of entelechy would take place. As we will see further on, the course of such reasoning will lead Driesch to the conceptual identification of entelecheia with the substantial form of Aristotle and the return to the conceptual roots proposed in antiquity by the master.

### **3. From the entelecheia category to the concept of substantial form. About the Conceptual Paradox of Hans Driesch**

Driesch decidedly rejects the possibility of identifying entelecheia with any kind of matter (physico-chemical) and also criticized the possibility of its origins from other chemical systems, posing a fundamental question in the scope of the discussed issue. Essentially, he wonders whether entelecheia could not simply be called merely a substantial form [D. S] in general philosophical meaning (in the sense of something irreducible, something that always remains the constant carrier of variable properties) as opposed to what is called a substance in the inorganic world (which can be understood in the purely chemical sense, or in the sense of matter theory) [Driesch 1921].

The problem that limits him in adopting such a research position are the two substances in relation to the organic nature itself and a certain convergence of his views with those of other philosophers proposed in the past. Therefore, the critical point of view of Driesch forbade him to assign to one of these substances some mental properties, as similar positions in the history of philosophy often did [Driesch, 1922]. In this aspect, Driesch explains:

Then there would be two substances with regard to nature, and our theory would become very similar to some theories of the past, though with the

remarkable difference that our idealistic view would not allow us to regard one of these two substances as “psychical,” as all other similar theories have done – Lotze’s being one of the latest [Driesch, 1908, p. 256]

Finally, the researcher distinguished one spatially-stretched matter, and one non-spatial substance, intensified entelecheia or substantial form. Both were supposed to relate to empirical reality, as long as it was nature itself. In his attempt to constitute the concept of entelecheia as a life-specific metaphysical concept – Driesch aims at the analytical derivation of the new natural system on the basis of facts and theoretical analyses that he had learned so far. Quite possibly, it could be an incompetent modification of the Aristotle science of substance. Also it can be pointed out that Driesch, in some of his analyses, also understood entelecheia as a soul in the thought of Aristotle, which is a peculiar driving force of the living body [Driesch, 1922]. However, the researcher attributes these properties to entelecheia as intended in his own interpretation, instead of the authentic meaning of Aristotle.

In Driesch’s view, entelecheia couldn’t be placed within a spatial-time framework, because deprived of spatial extensiveness and also of specific mental properties commonly associated with thinking. Its operation is based solely on the action in the direction towards the physical and material space based on physico-chemical laws. Among Driesch’s important arguments are:

Entelechy itself is conceived only; it is perceived only in its extensive results. Entelechy is not spatial, but only acts into space – I do not say “in” space – and the word “into,” of course, is itself not at all of a “spatial” character here. In this respect, as will come out fully later on, there is quite a gulf between entelechy and such natural agents as forces and energies, though the latter are also concepts, not percepts. Now it is clear that “dividing” is always understood as something spatial, and therefore it follows from all we have said that this word in its strict meaning is not at all applicable to entelechy. When we speak of “dividing” we always think of a something which we can cut into pieces. But entelechy cannot be cut in this manner, for the simple reason that it has no spatial dimensions at all: the “having dimensions” would contradict altogether the meaning of the term. [Driesch, 1908, p. 257-258]

Therefore, such an approach to entelecheia can be called an ordinary system of negation in the knowledge of a peculiar natural factor.

Entelecheia, in Driesch's view, is characterized by constancy and invariability, became an intensified metaphysical entity clearly sharing the properties of Aristotle's substance form, which was also the cause of morphogenetic processes. This also concerns the processes of regeneration and adaptation [Driesch, 1922]. It can also be stated that entelecheia, as a Driesch variant of substantial form, was a specific “program”, referring to the unlimited potentialities contained in living organisms, and supposed to express their essence in the deliberate organization of their biological structures and systems. *Entelecheia* was to be “activated” by organisms to function within morphogenetic structures of a living organism.

Such a precise concept of the entelecheia of constituent forms was already ready. It was supposed to be the basic element of Driesch's organic system in the phenomenological foundations of his explanation of living systems and their structural components. The interchangeable use of the concepts of entelecheia and substance, together with the laws in force within its scope, forced the researcher to try to reconcile these principles with the general ontological and logical principles, directly related to the science of inorganic matter. Such a cognitive approach – in effect, led the researcher to emphasize a peculiar structural relationship between organic and inorganic reality based on ontological *a priori* principles, which materialize empirically on the inorganic plane. In this sense, the conceptual *a priori* principles derived around the inorganic natural reality are reconciled by Driesch with the conceptual nature of the category of the entelechy-material form and its significant role within the framework of specifically understood vitalism. Although Driesch correctly interpreted organic phenomena in the area of morphogenesis, he had a huge methodological problem with the ultimate entrenchment of a factor integrating developmental processes whose essence was reduced to a pure concept, attributing to it properties that do not fall within any scientific framework and certainly within the methodology of science.

#### **4. General comparison of the (selected) basic concepts used by Aristotle and Hans Driesch in the interpretation of dynamic, goal-oriented processes in the morphogenesis. Matter, potency and energy**

The substantial form of Aristotle and its equivalent from Driesch's point of view are discussed above. That is why, at this point, I will focus my attention on the other (most important) categories, as an inherent component of these systemic rationality. The first matter in Aristotle's belief was the primary yet outdated substrate and the first cause of everything material. It is difficult to define what exactly is to be considered as a first matter in Aristotle's view, because as a purely possible element it is completely indeterminate and unrecognizable. This is determined by the absence of any formal factor. An important moment of Aristotle's *Physica* is:

The matter comes to be and ceases to be in one sense, while in another it does not. As that which contains the privation, it ceases to be in its own nature, for what ceases to be – the privation – is contained within it. But as potentiality it does not cease to be in its own nature, but is necessarily outside the sphere of becoming and ceasing to be. For if it came to be, something must have existed as a primary substratum from which it should come and which should persist in it; but this is its own special nature, so that it will be before coming to be. (For my definition of matter is just this – the primary substratum of each thing, from which it comes to be without qualification, and which persists in the result). And if it ceases to be it will pass into that at the last, so it will have ceased to be before ceasing to be [Aristotle, *Physica*, I, 191 a 10-14].

Therefore, it is proper to explain first matter in relation to what is already formed, because the first matter itself cannot be cognitively grasped. Driesch understood organic matter as a real existing structural basis of a living organism, based on the physical and chemical laws of the living organism, supported by assumptions of mechanistic theory. He writes:

We have analyzed morphogenesis into elementary processes, means, potency, formative stimulus, just as the physicist analyses mechanics into time, velocity, mass, and force; we have then rearranged our elements into “systems” – the equipotential systems, the harmonious-equipotential system in particular, just as the physicist composes his elements into the concepts of momentum or of kinetic energy or of work. And finally, we have discussed our compositions and have obtained our result, just as the physicist gets his ultimate results by discussing work and kinetic energy and momentum. [Driesch, 1921, p. 355]

The substance-based entelechy-form played a significant role in the management of organic processes through its “suspensory” influence. Contrary to the Aristotle first matter it is possible to ascribe basic properties to Driesch organic matter, in isolation from the substance form. These properties can be derived on the basis of the laws and scientific principles prevailing at that time. It can be said that Driesch simply overcame the mechanistic materialism adopted by his predecessors, approaching the pluralism of life stated by Aristotle since the beginning [Driesch 1935]. The first matter, in Aristotle’s view (what we can see this in his *Metaphysica*, VIII) is not derived from another cause (i. e., it is a natural beginning). Because of its essential potentiality, it has an unlimited basis for being a plastic material for “something material” (in some way formed). In turn (in *De generatione et corruptione*), Stagirite argues:

For, to begin with, it is characteristic of matter to suffer action, i.e. to be moved: but to move, i.e. to act, belongs to a different “power”. This is obvious both in the things that come-to-be by art and in those that come to-be by nature. [Aristotle, *De generatione et corruptione*, II, 335 b 28-31]

At the same time it does not have within itself (as a purely possible element) any “force” (act) which would lead to the spontaneous creation of anything from it [Ibidum].

What is created on the basis of the first matter does not arise in a spontaneous, unconventional way. The problem arising from the lack of determination (unlimited) of the first matter and its role in the formed matter is also important here. According to the concept of Aristotle's being, nothing can exist that is infinite. Everything that exists in any way is limited (formed) and for this reason we can say that it is. There can be no restrictions only on what is not regulated. Since the form constitutes an update of being, the unlimited character is expressed through potential. In this sense, we can speak of the first matter as pure potential, which is based on ambiguity. Only potentialities which are present in some being can be determined by a form; e. g. the

ability to be a musician is a specific potentiality, because it can only manifest itself in a being formed as a man. Therefore, the first matter – in Aristotle's view – as an ontological substrate has a potential nature and in order to fully occur in existence it needs to be updated by a form without which it remains undefined [Gondek, 2013].

Driesch, like Aristotle, stresses the prospective power of investigating the material system and each of its elements:

Now, if the potential be that which it has been declared to be, upon which energy is consequential, it is evident that it is not possible that it be true to say that this particular thing is endued with a capability of being, but yet will not exist; so that, on this supposition, what things impotential are would elude our search. [Aristotle, *Metaphysica*, VIII, 232]

This meant that each element (of Aristotle's terminology) has a certain potential that can be realized by each element of the material system. The fact is, wherever possible – that there is a proportionate development proved that this sum is not only a simple sum, but a kind of order. Driesch proposes:

Let us apply the term *equipotential ontogenetic system* to any ontogenetic totality which consist of cells with equal prospective potency, *i.e.* with an equal possible fate; then the blastula is, in short an *equipotential system*. [Driesch, 1914, p. 13]

You can call this order as a relationship between the dispositions in absolutely normal cases. However, it should be remembered that the term “prospective power”, or this relative proportionality, should always refer to this order. In this case we can use this expression without further explanation to denote the invariable factor (which Driesch named in his later metaphysical studies the “entelechy-substance form”), on which the prospective meaning of each part was dependent [Driesch 1921; Driesch 1901]. However, Driesch himself believed that one should not equate the category of “dynamics” with the contemporary meaning of the term “potentiality” or “potential energy” – at least not in every case – as he himself asserted [Driesch, 1922, p. 14]. These are interesting methodological nuances, which would require detailed discussion and comparison with Aristotle research. At this point, however, I am limiting myself to indicating general differences and similarities, discussed basic categories of both researchers-philosophers. Since the nature of the form – in Aristotle's view – is an activity, the scientist describes it as energy [Zięba, 1986]. Referring to Aristotle's *Metaphysica*:

But the name energy, which is combined with actuality, and tends towards other things, has proceeded, forth from motions principally; for motion in an eminent sense appears to constitute the energy of a thing. Wherefore, also, to nonentities they do not attribute the having motion imparted to them, but certain other categories: as, for instance, things which are nonentities are intelligible and desirable objects, but are not in motion. And this is the case because nonentities in energy will, however, subsist in

energy; for of nonentities some are nonentities in capacity, but yet have no existence because they do not exist actually [Aristotle, *Metaphysica*, VIII, 232].

The form of the substance was an important component of being, therefore energy and activity were also the essence of being. As Wladyslaw Tatarkiewicz shows, energy (act) – from Aristotle's point of view – can mean something accomplished, but also activity, and then it is identified with the term ἐντελέχεια [Tatarkiewicz, 1910]. However, this does not mean that energy has taken up some space, but simply “works”. It was not a fundamentally new concept, but in the case of hilozoicists it was only considered the principle of nature, which is a force. However, Aristotle clearly formulated the energy concept of existence [Tatarkiewicz 2009]. Thus, the potency in this perspective was understood as an opposite and a supplement to energy.

### Conclusion

The aim of this article, done from a Biocosmological perspective, is to provide an analysis and present a methodological assessment of the two research perspectives (Aristotle's and Hans Driesch's) pertaining to an explanation of morphogenetic integrative peculiarities as the integral part of living organisms development. Within the thus specified subject matter, the author attempts to show not only the evolution of fundamental concepts, essentially including *entelecheia*, but also aims at explaining the meaning of other categories presented in both research systems. In this approach, he endeavors to analyze substantially the grounds of Aristotle's and Driesch's methodologies (and their biocosmologies, in general). In his overriding conclusion, the author takes the view that Hans Driesch efficiently used the basic principles of the Aristotelian teleological physics (Organicist naturalism) and, thus – he laid (in our modern times) the bases for the essential Organicist approaches in studying both the actual issues of morphogenesis, and likewise aimed at dealing with the contemporarily challenging problems of scholarly explanation and understanding of the life on Earth as an excellent harmonious whole – a superb symbiosis of all the existing living things, from micro- to macro-levels of integrated organizations. The latter calls for a special (precisely Organicist) study of *matter*, *energy* and *information* (self)evolving interrelation and permanent circulation in the whole sphere of Earth's (Kosmic) life.

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